What is claimed is:

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1. An ion doping apparatus comprising:

a gas source for introducing a dopant gas and a second gas for diluting said dopant gas into a chamber;

a power source for generating a plasma of said dopant gas and said second gas;

a extraction electrode for extracting ions of said dopant gas and said second gas;

a magnet for separating the extracted ions on a mass basis;

a slit for cutting a first portion of said ions separated by said magnet while allowing a second portion of said ions to pass through said slit;

a substrate to be subjected to a flow of said second portion of said ions wherein said flow of the second portion of said ions has a cross section at said substrate, said cross section being elongated in one direction, and

moving means for moving said substrate in an orthogonal direction to the elongation direction of said cross section.

2. An apparatus according to claim 1 wherein said magnetic field is substantially in parallel with an elongation direction of said cross section.

3. An apparatus according to claim 1 wherein said dopant gas comprises a material selected from the group consisting of phosphine and diborane and said second gas comprises hydrogen.

4. An apparatus according to claim 1 wherein said first portion of the ions contains said second gas and said second portion of the ions contains said dopant gas.

5. An apparatus according to claim 1 further comprising an acceleration electrode for accelerating the second portion of said ions passed through said slit toward said substrate.

6. An ion doping apparatus according to claim 1 wherein said magnetic field has a strength in a range of from 0.1 to 10 tesla.

7. An ion doping apparatus comprising:

an ion source containing ions of a dopant gas;

an extraction electrode for extracting the ions of said dopant gas;

a magnet for producing a magnetic field to separate the extracted ions on a mass basis;

an acceleration electrode for accelerating the extracted ions toward a substrate so that said substrate is irradiated with a beam of said ions wherein said beam has an elongated cross section at said substrate;

a substrate holder for holding said substrate; and

moving said substrate in an orthogonal direction to the elongation direction of said elongated cross section,

wherein said magnet is located between said plasma extraction electrode and said acceleration electrode.

8. An ion doping apparatus according to claim 7 wherein said magnetic field has a strength in a range of from 0.1 to 10 tesla.

9. An ion doping apparatus according to claim 7 further comprising a suppressor electrode for conditioning a shape and a distribution of said beam wherein said suppressor electrode is supplied with a voltage having an opposite polarity to a voltage applied to said acceleration electrode.

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10. An ion doping apparatus comprising:

an ion source containing ions of a dopant gas;

an extraction electrode for extracting the ions of said dopant gas to form a flow of ions of the dopant gas;

an acceleration electrode for accelerating the flow of the ions of the dopant gas toward a substrate;

a substrate holder for holding said substrate; and

coils located between said extraction electrode and said acceleration electrode to shape a cross section of said flow into a line shape wherein said cross section is taken along a plane perpendicular to the flow; and

means for moving said substrate in an orthogonal direction to an elongation direction of said line shaped cross section.

11. An apparatus according to claim 10 wherein a diameter of said coils is monotonically decreased as the flow of said ions extends downstream.

12. An apparatus comprising:

a gas source for introducing a dopant gas and a second gas for diluting said dopant gas into a chamber;

a power source for generating a plasma of said dopant gas and said second gas;

a extraction electrode for extracting ions of said dopant gas and said second gas;

a magnet for separating the extracted ions on a mass basis;

a slit for cutting a first portion of said ions separated by said magnet while allowing a second portion of said ions to pass through said slit;

a substrate to be subjected to a flow of said second portion of said ions wherein said flow of the second portion of said ions has a cross section at said substrate, said cross section being elongated in one direction; and

a laser irradiation means for irradiating said substrate with a laser beam while moving said substrate in a direction orthogonal to an elongated cross section of

said laser beam after said substrate is subjected to said flow of said ions.

13. An apparatus according to claim 12 wherein said magnetic field is substantially in parallel with an elongation direction of said cross section.

14. An apparatus according to claim 12 wherein said dopant gas comprises a material selected from the group consisting of phosphine and diborane and said second gas comprises hydrogen.

15. An apparatus according to claim 12 wherein said first portion of the ions contains said second gas and said second portion of the ions contains said dopant gas.

16. An apparatus according to claim 12 further comprising an acceleration electrode for accelerating the second portion of said ions passed through said slit toward said substrate.

17. An apparatus according to claim 12 wherein said magnetic field has a strength in a range of from 0.1 to 10 tesla.

18. An apparatus comprising:

an ion source containing ions of a dopant gas;

an extraction electrode for extracting the ions of said dopant gas;

a magnet for producing a magnetic field to separate the extracted ions on a mass basis;

an acceleration electrode for accelerating the extracted ions toward a substrate so that said substrate is irradiated with a beam of said ions wherein said beam has an elongated cross section at said substrate; and

a laser irradiation means for irradiating said substrate with a laser beam while moving said substrate in a direction orthogonal to an elongated cross section of said laser beam after said substrate is irradiated with said beam of said ions,

wherein said magnet is located between said plasma extraction electrode and said acceleration electrode.

19. An apparatus according to claim 18 wherein said magnetic field has a strength in a range of from 0.1 to 10 tesla.

20. An apparatus according to claim 18 further comprising a suppressor electrode for conditioning a shape and a distribution of said beam wherein said suppressor electrode is supplied with a voltage having an opposite polarity to a voltage applied to said acceleration electrode.

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